Fall 2019

EART 12 Intro to Weather and Climate

Many meteorological phenomena are familiar to us: clouds, fog, rain, snow, wind, lightning, and severe storms. However, the climate—weather averaged over decades and longer—is changing in response to human activities. In this course, we will use physics and chemistry to build an understanding of the fundamental features of the atmosphere from first principles as much as possible. The goals are to understand how weather and climate on Earth works, what is the climate forecast, and what can we do as individuals and as a society to mitigate the impacts of climate change.

This course fulfills a statistical reasoning (SR) requirement. Hence we will focus on developing skills in approaching quantitative data and statistical reasoning, in order to make judgements in situations of uncertainty (like weather forecasting and climate prediction!).

Meets: MWF 1:20PM-2:25PM, Thimann 001

Discussion Sections:

M 9:00AM-10:00AM, EMS D250

M 10:15AM-11:15AM, EMS D250

T 5:00PM-6:00PM, EMS D250

T 6:15PM-7:15PM, EMS D250

Instructor: Prof. Nicole Feldl

Email: nfeldl@ucsc.edu

A note about emails: I prefer to be called Professor or Professor Feldl. When you email me, if you lead with “Dear/Hi Professor” I will be in a better mood to respond to your query. If you have preferences for how you are addressed, let me know and I will honor that.

Office: EMS A247

Office Hours: Wednesday 3:00-5:00PM or by appointment

TA: Mason Leandro

Email: maleandr@ucsc.edu

Office: EMS C303

Office Hours: Thursday 1:00-2:00PM or by appointment

Course website: https://canvas.ucsc.edu/

Grading: Quizzes (20%), Assignments (25%), Midterm Exam (25%), Final Exam (25%), Attendance (5%)

Textbook: *Weather: A Concise Introduction* by Hakim and Patoux (2018). A copy of the book will be on reserve at the Science & Engineering Library. Additional readings will be provided as needed.

HOMEWORK POLICY: There will be weekly homework throughout the quarter. The homework will consist of 2 parts:

i. Quizzes to practice your foundational knowledge of weather and climate

ii. Assignments to develop skills in approaching quantitative data and statistical reasoning

Homework will be due on Canvas on the stated due date. Solutions to homework will be discussed in section. Late homework will not be accepted. However, I will automatically drop your lowest quiz grade and your lowest assignment grade without penalty. That said, the assignments are incremental, and you will need to have completed previous assignments in order to complete subsequent ones.

Exam Policy: Makeup exams will not be scheduled. They will be allowed only for medical reasons or in extraordinary circumstances. If you believe you have an extraordinary circumstance, contact the instructor as soon as possible.

Getting Help: If you have questions about the assignments, we invite you to come to office hours. If a schedule conflict prevents you from attending office hours, we invite you to make an appointment with the TA or professor. Additionally, small group tutoring will be available through Learning Support Services. To participate, please sign up at https://lss.ucsc.edu/programs/small-group-tutoring/. Priority will be given to students who sign up early in the quarter and attend regularly.

Online Materials: Blackboard lectures notes will not be posted online. To obtain the lecture material, you are expected to attend class and take notes. If you are absent from lecture, you can find the material in your textbook (see schedule below for readings associated with all lectures). It is also a good idea to meet with a classmate to review the material. The instructors are not available to review the material with you. However, if, after you have reviewed the material on your own or with a classmate, you have specific questions, you are welcome to bring them to office hours. Any slides/visuals from lecture will be posted online.

Academic integrity: The cornerstone of intellectual life at UC Santa Cruz is a commitment to integrity in all forms of teaching, learning, and research. Cheating, plagiarism, and all other forms of academic misconduct will not be tolerated. Suspected or admitted cases will be reported to your college provost, which will result in a permanent record, and possible additional consequences such as suspension or dismissal from the University. Students are responsible for becoming familiar with Sections 102.01–102.016 and 105.15 of the UC Santa Cruz Student Policies and Regulations Handbook.

Disability accommodation: UC Santa Cruz is committed to creating an academic environment that supports its diverse student body. If you are a student with a disability who requires accommodations to achieve equal access in this course, please submit your Accommodation Authorization Letter from the Disability Resource Center (DRC) to me privately during my office

hours or by appointment, preferably within the first two weeks of the quarter. At this time, I would also like us to discuss ways we can ensure your full participation in the course. I encourage all students who may benefit from learning more about DRC services to contact DRC by phone at 831-459-2089 or by email at drc@ucsc.edu.

Tentative Schedule

Module 1 - Introduction to the Atmosphere

1. Intro - Chapter 1.1
2. Pressure and Ideal Gas Law - Chapter 1.2, Box 1.3
3. Weather Maps - Chapter 2.1-2.3
4. Atmospheric Composition and Structure - Chapter 3.1-3.2, 3.5
5. Carbon Cycle - Chapter 3.3
6. *Topics in Climate Change* - Perturbed Carbon Cycle - Chapter 3.4

Assignment 1 - Collecting and Displaying Data - due Friday October 11
Quiz 1 - due Friday October 11

Module 2 - Heat and Radiative Transfer

7. Heat and Energy Transfer - Chapter 4.1-4.2, Chapter 5.1
8. Electromagnetic Radiation - Chapter 4.3
9. Blackbody Radiation - Chapter 4.4

Assignment 2 - Greenhouse Effect - due Friday October 18
Quiz 2 - due Friday October 18

10. Greenhouse Effect - Chapter 4.4
11. Greenhouse Gases - Box 4.4
12. *Topics in Climate Change* - Climate Feedbacks - Box 4.5, Chapter 4.5

Assignment 3 - Greenhouse Gases - due Friday October 25
Quiz 3 - due Friday October 25

Module 3 - Atmospheric Thermodynamics

13. 1st Law of Thermodynamics and Adiabatic Processes - Chapter 6.1-6.3
14. Water Vapor - Chapter 5.2-5.7
15. Moist Adiabatic Processes - Chapter 6.4-6.5

Assignment 4 - Data, Population, and Statistics - due Friday November 1
Quiz 4 - due Friday November 1

Module 4 - Clouds

16. Cloud Formation - Chapter 6.6-6.9
17. Cloud Atlas - Appendix 6.1
18. Midterm Exam - Friday November 8

University Holiday - Monday November 11

19. Warm Clouds - Chapter 7.1-7.2
20. Cold Clouds and Optical Phenomena - Chap 7.3, Appendix 7.1

Assignment 5 - Linear Regression - due Friday November 15
Quiz 5 - due Friday November 15

Module 5 - Wind and Circulations

21. Fundamental and Apparent Forces - Chapter 8.1-8.4
22. Geostrophic Balance and Surface Winds - Chapter 8.5-8.8
23. Global Circulations - Chapter 9.1-9.3
24. *Topics in Climate Change* - Numerical Modeling of Weather and Climate - Chapter 13

Assignment 6 - Hypothesis Testing - due Friday November 22
Quiz 6 - due Friday November 22

Module 6 - Weather

25. Extratropical Cyclones - Chapter 10
26. Tropical Cyclones - Chapter 12

University Holiday - Friday November 29

Assignment 7 - Significance of a Trend - due Monday December 2
Quiz 7 - due Monday December 2

Module 7 - Climate

27. Climate Variability - Chapter 9.4
28. Climate Change - Chapter 15
29. Climate Impacts, Adaptation & Mitigation

The midterm exam will be Friday, November 8.
The final exam will be Monday, December 9, 8:00-11:00AM.